A Retrospective study into the pain experienced during therapeutic spinal injections (nerve root blocks and foraminal epidurals) and subsequent patient outcome

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Ethical Approval Not Required

Abstract

Aims/objective: To compare pain experienced and outcome in patients receiving spinal injections for radicular leg or back pain.
Study design: Retrospective study
Patient sample: A total of 167 patients who received nerve root block or foraminal epidural injections between 13/7/18-01/12/21 for radicular pain.
Method: Using a private sector database, 292 spinal injection forms were filtered to select patients who had received spinal nerve root blocks or foraminal epidurals. Private and NHS notes were reviewed to exclude a total of 43 patients who had had previous spinal injections or operations before 13/7/18. Pain provocation at time of injection was recorded, alongside age and diagnosis. Six-week follow up data on the system was analysed to determine outcome, and whether patients were listed for or received surgery. Post injection questionnaires were also sent to all 249 patients.
Results: A total of 167 patients had a complete data set for analysis (57.2%). Outcome was divided into three categories, “did not work”, “worked and wore off” and “worked”. Pain provocation at the time of the injection was recorded at the time of injection into 4 categories “none”, “weak”, “moderate” and “strong”. The numbers of patients in each group were recorded and correlated to outcome. There was no significant correlation found between the pain provocation groups and their subsequent outcomes ($p=0.994$). Pain provocation related to whether or not a patient received surgery was also not shown to be significant ($p=0.68$)
Conclusion- In this study we found no significant link between the various pain experienced by spinal injections and the subsequent patient outcomes.

Introduction

In patients with lumbar or sacral spinal pathologies, one of the most common subcategories are those with radicular leg pain as a result of the nerve root involvement (1). This pain can be very debilitating for people and it has been shown that patients who have lower back pain associated with leg symptoms have a worse prognosis than those with localised back pain only (2) . Lumbosacral radicular leg pain symptoms can present as a burning or stabbing pain down the posterior thigh, radiating to the leg, sometimes being felt in the groin, abdomen or anterior thigh (3, 4). There are many causes of radicular pain, with the most common cause being disc herniation, other causes include spondylolisthesis or vertebral subluxation, these all result in narrowing of the spinal canal and subsequent nerve compression (3). Lumbar and sacral stenosis is used to describe the anatomical reduction of the spinal canal, divided into the

subtypes of central canal, lateral recess, foraminal or a combination (5). Stenosis results in symptoms such as generalised lower back pain, buttock and leg pain, weakness, numbness or tingling and loss of sensation (6).

The first line treatments for leg pain are generally conservative measures, including physiotherapy, NSAID use and lifestyle changes. Failing these, nerve root block and transforaminal epidural steroid injections can be highly effective. These injections are especially useful in those who are unfit for surgery or have a non-surgical preference. A selective nerve root block involves the injection of steroids and local anaesthetic into the area where the nerve root leaves the foramen of the spine under X-Ray guidance, these can be performed diagnostically or therapeutically (7). The steroid is used predominantly to decrease inflammatory markers, but the fluid volume of steroid itself can result in the dura being displaced forward and inwards, stretching the nerve roots (8). This process can result in neurolysis and subsequently increase pain reduction.

There have been various studies looking into predicting outcome in spinal injections. A study in 2015 found that provocation of concordant radicular pain did not predict the outcome of pain at short term follow up after transforaminal epidural injections (9), so we aimed to see if our research was consistent with this. Additionally, a study from 2013 showed that the immediate pain relief from transforaminal epidural injections does not predict the long-term outcome (10).

Aims

The aim of this study was to determine whether there was a significant correlation between the pain provocation or pain experienced during transforaminal epidurals and selective nerve root blocks and the subsequent patient outcome. We also looked into secondary outcome factors such as whether patients received surgery following the injection, whether age was factor in pain and the overall efficacy of the injections.

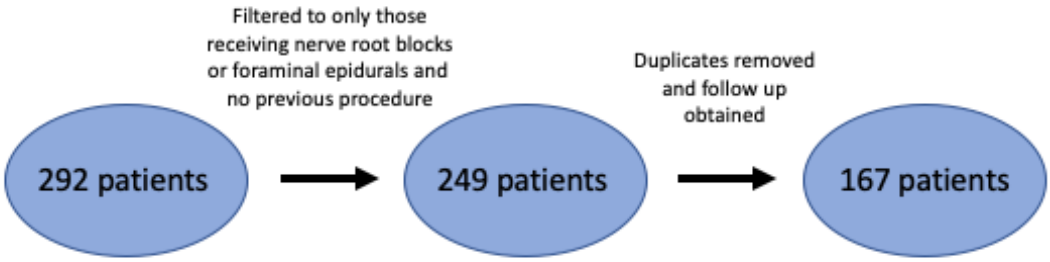
Methodology

Patient selection

Using a database of 292 private patients receiving spinal injections, those who received either a nerve root block or a transforaminal epidural injection between 13/7/18-01/12/21 were used. These injections were all performed by the same spinal surgeon and technician. Welsh clinical portal was also used to exclude patients who had received previous spinal procedures or injections before 13/7/18. Both of these criteria resulted in the exclusion of 43 patients. For the duplicate names i.e. Those who received more than one injection between those dates, the first injections were recorded, providing that they had been followed up, if not, only the followed-up injection was used. Patient notes from 6-week post-injection consultations were recorded.

Data collection

Due to only 110 patients with follow up appointment notes, the decision was made to send out post injection questionnaires to all 249 patients, of which 81 questionnaires were returned. The questionnaire data superseded any follow up data we had before. A total of 167 patients had a complete data set for analysis (57.2%)



All patients in the cohort received either a nerve root block or foraminal epidural. The pain experienced from the injection was recorded at the time on the procedure form using tick box of pain provocation with the following options:

- ***No pain/provocation***
- ***Weak pain provocation***
- ***Moderate pain/provocation***
- ***Strong pain/provocation***

A combination of the 6-week follow up forms on the database and the post injection questionnaires were used to determine the outcome of the injection. We used three categories for this “did not work”, “worked then wore off” and “worked”, classifying an improvement of pain as ‘worked’ if there was an overall reduction in pain. NHS and private notes were reviewed to determine whether a patient had been listed for, or received surgery following injection.

The post spinal questionnaire sent out to all patients included a number of extra questions. Patients were asked to rate their back and leg pain before and after the injection out of 10. It also asked if they experienced pain relief immediately after injection and how long their pain was reduced for, with options from 0 to 6 weeks as well as their total percentage pain reduction. Whether or not the pain recurred after 6 weeks was also recorded, including the nature of the pain recurrence, using categories ‘pain came back better’ 1 as ‘pain is the same’ and 2 for ‘the pain is worse’.

The scores were analysed by IBM SPSS statistics, comparing the pain provocation, injection outcome, recurrence of pain and spinal surgery. During the analysis the statistically significance was marked at $p<0.05$. Chi squared tests were performed to determine the difference between the categorical variables.

Results

The average age of the patients receiving injections was calculated at 59.6 years with a standard deviation of 16.2 years. Of these patients 97 were male (58.1%) and 70 were female (41.9%). 137 (82.0%) had a diagnosis of a disc prolapse and 30 (18.0%) had spondylolisthesis.

Table 1-Pain provocation vs outcome

		Outcome (% of outcome)			
		Did not work	Worked and wore off	Worked	Total
Pain Provocation	None	**1** (3.6%)	**1** (1.4%)	**1** (1.4%)	**3** (1.8%)
	Weak	**4** (14.3%)	**9** (13.0%)	**10** (14.3%)	**23** (13.8%)
	Moderate	**13** (46.4%)	**34** (49.3%)	**35** (50.0%)	**82** (49.1%)
	Strong	**10** (35.7%)	**25** (36.2%)	**24** (34.3%)	**59** (35.3%)
	Total	28	69	70	167

Table one shows the proportions of pain provocations ranging from 'none' to 'strong' within the categories of "did not work, worked and wore off or worked". Of those whose injections were not successful, 3.6% had no pain provocation, 14.3% had weak pain provocation, 46.4% had moderate pain provocation and 35% had strong pain provocation. In those where the injection worked and wore off, moderate pain provocation was the largest proportion at 49.3%, then strong at 36.2%, weak at 13% and none at 1.4%. In injections with the best outcomes, that 'worked', the highest proportion was in moderate pain provocation at 50%, then strong provocation at 34.3%, then weak at 14.3% and then no provocation. In terms of the overall proportions of provocation,

moderate was the highest proportion experienced by patients at 49.1% of all injections, with no pain provocation only experienced by 3 patients making up 1.8% of all injections.

There was no significant correlation between pain experienced during injection and outcome (p=0.994), in line with previous literature. The Cramer's V value was also 0.047, showing no association between the two variables.

Table 2: Surgery outcomes compared to pain provocation

		Surgery? (% of category)		
		Listed for/ had surgery	No surgery	Total
Pain Provocation	None	0 (0%)	3 (2.6%)	3
	Weak	5 (10%)	18 (15.5%)	23
	Moderate	26 (52%)	56 (48.3%)	82
	Strong	19 (38%)	39 (33.6%)	58
	Total	50	116	166

Of the patients that received surgery the highest percentage was made up of those who experienced moderate provocation in injection (52%). In those who did not receive surgery the highest proportion was also the moderate pain provocation (48.3%). A chi squared test performed to see if there was correlation between pain provocation and requirement for surgery found that there was no significant relationship between the variables (p=0.68). However, the overall number of people requiring surgery following the injection (50 or 30.1%) was lower than those who did not (116 or 69.5%).

Figure 1: age compared to pain experienced during injection

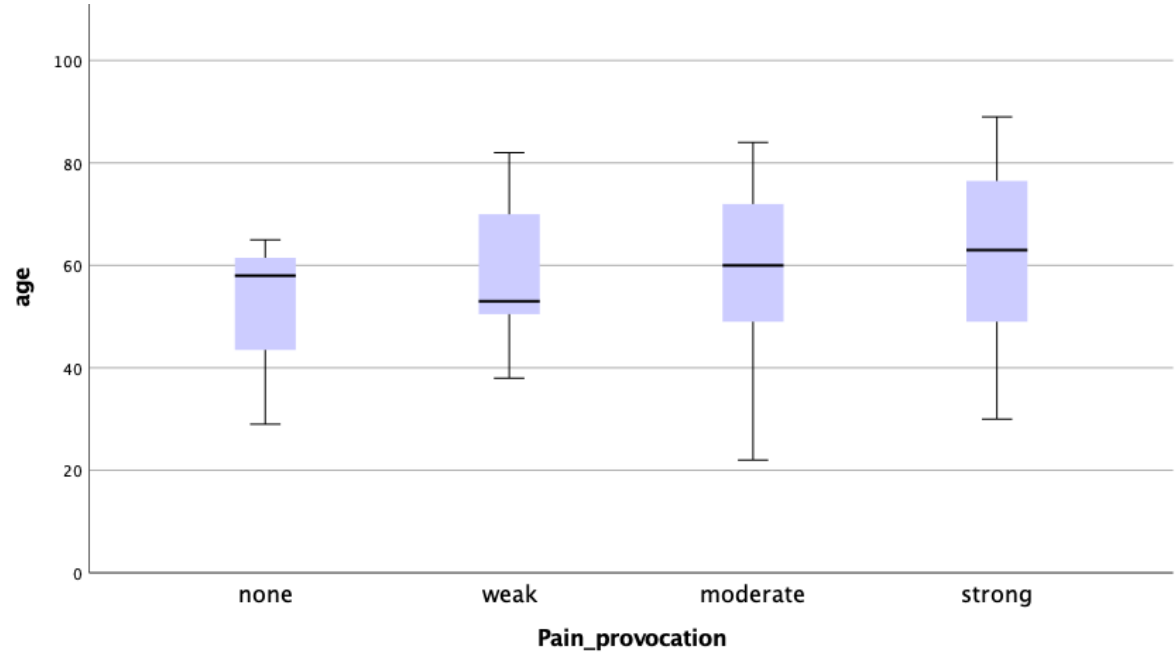
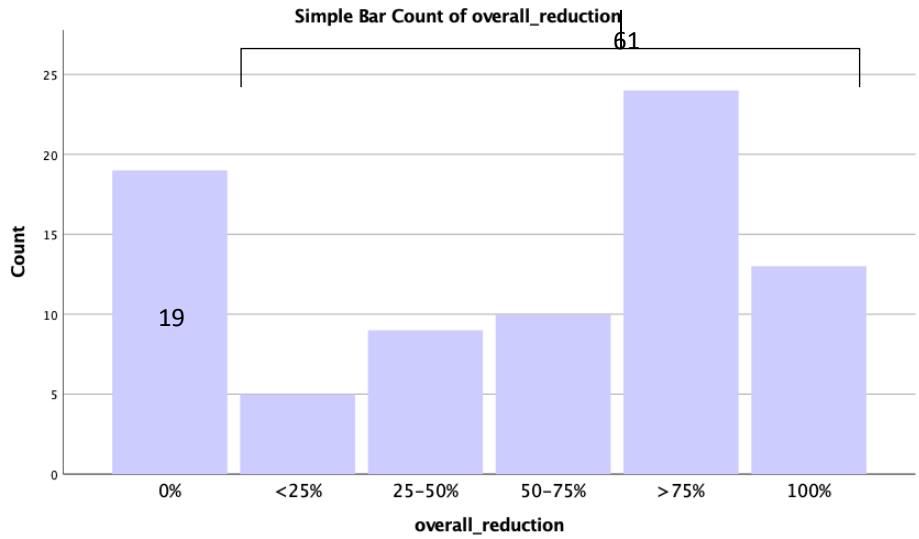


Figure 1 shows that there is no significant difference between age and pain experienced during the injection (p=0.193).

Figure 2 is a bar chart showing the overall percentage reduction in pain from the 81 questionnaires. The highest proportion was in those with >75% reduction of their pain. However, this bar chart does show a higher number of patients (61) who experienced some degree of reduction of pain than those with no reduction at all (19) from the injections.

Figure 2- overall reduction in pain (%)



There was not a significant link between the pain experienced and outcome at follow up in those patients that returned the questionnaires (p=0.108). Table 3 shows the proportions of pain provocations in each outcome. (Missing data n=1). The highest proportion of those, who had 100% pain

reduction, experienced moderate pain on injection (53.8%). However, in those that experienced no pain improvement, moderate pain provocation was also the largest proportion of the category (57.9%).

Table 3-overall reduction in pain compared to pain provocation in patient questionnaires

		Overall reduction in pain (% of category)						
		0%	<25%	25-50%	50-75%	>75%	100%	Total
Pain provocation	None	0 (0%)	0 (0%)	1 (11.1%)	2 (20.0%)	0 (0%)	0 (0%)	3 (3.8%)
	Weak	1 (5.3%)	2 (40%)	2 (22.3%)	0 (0%)	1 (4.2%)	2 (15.4%)	8 (10.0%)
	Moderate	11 (57.9%)	2 (40.0%)	5 (55.6%)	4 (40.0%)	13 (54.2%)	7 (53.8%)	42 (52.5%)
	Strong	7 (36.8%)	1 (20.0%)	1 (11.1%)	4 (40.0%)	10 (41.7%)	4 (30.8%)	27 (33.8%)
		19	5	9	10	24	13	80

A total of 55 patients (68.8%) experienced immediate relief after the injection and 25 (31.2%) did not. There was no significant correlation found between the pain relief at the time of the injection and outcome (p=0.477).

Discussion

The results we obtained from this study are in line with previously published data (9). There was no effect of pain provocation on outcome of nerve root block or transforaminal epidural injections.

There were a number of limitations in our study, including selection bias which could be present as a result of inadequate patient follow up. Whilst some questionnaires were returned from those patients who did not receive follow up, some of those patients may have been recalling injections from over a year ago, leading to discrepancies in the follow up data. There were 110 patients from the 249 (44.2%) who had a 6 week follow up appointment. This smaller proportion of people is likely to be as a result of the injections being given in the private sector, hence the cost of appointments acting as a deterrent for some of the patients.

The strengths of the study include a relatively large cohort size with categorised pain provocation. As well as this, the injections were all performed by the same surgeon and technician for consistency.

With regards to the data on surgical outcomes, we feel that it supports the efficacy of spinal injections as a conservative measure for leg pain as only 30.1% of patients went on to require surgery. However, it must be considered that the data may have been bias due to a proportion of those receiving injections who are unfit for or do not want surgery. It is also important to remember that these injections are therapeutic and not curative as the underlying pathology can remain, hence surgery will be the ultimate target for some patients.

Digital transformation of spinal injections

Part of our project was to undertake a service improvement involving the digital transformation of the current spinal injection forms used by the clinicians following the procedure. Since the injection service has been postponed as a result of the COVID-19 pandemic, this gives an opportunity to transform the process of collection of pre and post procedural data in University Hospital Wales in the new spinal injection suite. This will allow for efficient data collection and direct upload into the patient's notes.

This will result in a more practical and efficient way for forms to be filled in, as well as a more environmentally friendly method to record data, reducing paper wastage. We used Adobe acrobat software to create fillable pdf forms which can be completed on tablets or computers. We changed the current injection form to include various parameters for the pain, identified for our project. The section for pain provocation will feed into a prospective research study, where we have coded the forms to transfer into a database to allow us to revisit a sufficient data set in the future. This digitalised form will make it easier to congregate data for other studies on spinal injections in Cardiff. Furthermore, it will ultimately lead to more research into how patient outcomes from spinal injections can be improved. The findings can be used to see if there are any changes that can be made in the treatment process.

Conclusion

The results do not show any conclusive links between the pain experienced at the time of nerve root blocks or transforaminal epidural injections and subsequent patient outcome. However, due to the cohort size used and the discrepancies between the follow up data, we plan to revisit this study in one year alongside the new spinal injection proformas to further contribute to the improvement of this service and knowledge of this type of treatment.

References

1. Stynes S, Konstantinou K, Dunn KM. Classification of patients with low back-related leg pain: a systematic review. BMC Musculoskelet Disord. 2016;17:226.
2. Kongsted A, Kent P, Albert H, Jensen TS, Manniche C. Patients with low back pain differ from those who also have leg pain or signs of nerve root involvement - a cross-sectional study. BMC Musculoskelet Disord. 2012;13:236.
3. Manchikanti L, Singh V, Boswell MV. chapter 83 - Lumbar Radiculopathy. In: Waldman SD, Bloch JI, editors. Pain Management. Philadelphia: W.B. Saunders; 2007. p. 758-68.
4. Vivian DG. 39 - Discogenic Pain, Internal Disc Disruption, and Radicular Pain. In: Lennard TA, Walkowski S, Singla AK, Vivian DG, editors. Pain Procedures in Clinical Practice (Third Edition). Saint Louis: Hanley & Belfus; 2011. p. 441-59.
5. Genevay S, Atlas SJ. Lumbar spinal stenosis. Best Pract Res Clin Rheumatol. 2010;24(2):253-65.
6. Osman A, Hu W, Jianhua S, Li J, Luo X, Han N, et al. Caudal epidural steroid injections versus selective nerve root blocks for single-level lumbar spinal stenosis: a study protocol for a randomized controlled trial. Trials. 2021;22(1):524.
7. Kanaan T AR, Abuasbeh J, Al Jammal M, Al-Haded S, Al-Rafaiah S, Kanaan A, Alnaimat F, Khreesha L, Al Hadidi F, Al-Sabbagh Q. The Efficacy of Therapeutic Selective Nerve Block in Treating Lumbar Radiculopathy and Avoiding Surgery. J Pain Res. 2020:2971-8.
8. Viswanathan VK, Kanna RM, Farhadi HF. Role of transforaminal epidural injections or selective nerve root blocks in the management of lumbar radicular syndrome - A narrative, evidence-based review. J Clin Orthop Trauma. 2020;11(5):802-9.
9. McCormick Z, Margolis S, Temme K, Rivers E, Cameron SA, Smith MC, et al. Concordant pain provocation during transforaminal epidural steroid injection for lumbosacral radiculopathy: effect on pain outcome and predictive factors. Pain Physician. 2015;18(1):E19-26.
10. Wald JT, Maus TP, Geske JR, Diehn FE, Kaufmann TJ, Murthy NS, et al. Immediate pain response does not predict long-term outcome of CT-guided cervical transforaminal epidural steroid injections. AJNR Am J Neuroradiol. 2013;34(8):1665-8.